Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of

Amendment of Parts 1, 2, 22, 24, 27, 90 and 95	)	
of the Commission's Rules to Improve Wireless	)	WT Docket No. 10-4
Coverage through the Use of Signal Boosters	)	

RESPONSE TO MILLARD/RAINES PARTNERSHIP ("SMART BOOSTER")

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Purpose

This will respond to the so-called "ex parte communication" that the Millard/Raines Partnership ("Smart Booster") filed in WT Docket No. 10-4 on May 16, 2012. It is intended to ensure that the errors and misrepresentations in the Smart Booster presentation do not mislead the Commission.

Introduction

Smart Booster demonstrates that it generally doesn't understand the operation of a booster deployed in a real world situation. In the coverage area tests described by Wilson's report of February 29, 2012 (received by the Commission on March 1, 2012), using a signal booster caused a 20 dB average improvement in signal strength relative to the signals transmitted and received by a cell phone without a booster. This results from a typical signal improvement of 10 to 15 db for signals passing through a vehicle to and from a cell phone depending on the location and orientation of the phone within the vehicle, as compared to a phone outside the vehicle. In addition, the received signal within the vehicle improves as a result of using a more efficient antenna system on the roof of the vehicle as compared to the phone's internal antenna. The radiated power of the cell phone alone is reduced due to its antenna inefficiency, while a booster has generally more output power than a cell phone alone as well as a more efficient outside antenna. Therefore, a cell phone used with a booster has approximately a 20 dB advantage over a typical CDMA phone without a booster as employed in the tests presented by Wilson.

Response

The following will respond to, or refute, Smart Booster's claims, which will be quoted and highlighted in red.

> "It has less output power than many popular handsets alone, and provides much less output power than nearly all of the signal boosters presently on the market…" (Page 4)

In fact, the majority of CDMA handsets have a conducted output power of 23 to 24 dBm, and depending on the handset antenna inefficiency can reduce the radiated power level further. The proposed boosters can have an output conducted and radiated power of 30 dBm (1 watt), which is similar or higher power than most CDMA phones. Also, Smart Booster doesn't understand that if a booster's output power is a few dB less than a cell phone alone, there will be an overall signal improvement using a booster with an outside antenna (located on the roof of a vehicle or building) due to eliminating the losses suffered by signals passing through the vehicle or building.

> "For many reasons, the Joint Proposal in its present form is both a tragedy and a disaster. It will be a tragedy for the consumer because the Consumer Grade signal booster specified by the Joint Proposal is nothing

> more than an expensive toy. It lacks sufficient power to provide reliable wireless communication to users in rural areas and in other areas of marginal or unusable signal strength." (Page 10)

One Watt radiated power is enough power to adequately serve customers in weak signal areas because using an outside antenna eliminates signal losses caused by signals passing through the walls of a building or a vehicle. As a result, signals in both directions are actually improved by approximately 20 dB (100 times) relative to a typical cell phone without a booster. Wilson has received thousands of testimonials attesting to the fact that its booster has improved cellular phone service in rural areas. Many have been received from first responder organizations stating that Wilson boosters have aided them in the protection of life and property. Wilson is astonished by this comment by Smart Booster. We can only conclude that Smart Booster is prevaricating or has no understanding of the joint technical proposal.

> "The Joint Proposal will be a disaster for wireless network providers because it will not prevent interference to both present and future versions of their networks. A consumer Grade signal booster with a specified output power of 23 dBm, 25, dBm, or even 30 dBm, depending upon whose comments to these proceedings may apply, is more than sufficient in urban areas to cause crippling interference to base stations that are designed to expect an RSSI in the neighborhood of -95 dBm. Today's newer 4G technologies expect an RSSI significantly less than that value, and Consumer Grade signal boosters will present an even greater threat to them. For example, LTE (Long Term Evolution) wireless technology expects an RSSI of less than -114 dBm." (Page 10)

Once again Smart Booster exhibits it propensity to speak from a lack of understanding. Verizon and T-Mobile specifically have fashioned their proposal as a cellular network protection specification. Sprint & AT&T recently filed ex partes that also accept the safe harbor technical/specifications with minor modifications. Obviously Smart Booster has no confidence in the engineering departments of Verizon, T-Mobile, AT&T, Sprint, and believes that they are unable to protect the integrity of their own networks. Boosters using the proposed protections shut down automatically in areas with high signal levels, i.e. whenever they could potentially interfere with nearby cell sites. The protections proposed in the Joint Proposal adequately protect systems using LTE and other technologies from overload interference, adjacent channel interference, noise floor interference, oscillation interference, OOBE (Out of Band Emissions), and others and will provide sufficient linearity to ensure optimum data rates are not degraded. It appears that Smart Booster doesn't have a technical understanding of the protections proposed by the Joint Proposal.

> "The above conclusions were supported by rigorous engineering computations and design curves that were submitted in Reply Comments by Smart Booster submitted August 24, 2011. Smart Booster stands by

> those conclusions, and there is no need to repeat the supporting calculations in detail here." (Page 11)

Wilson will defer to the Commission's assessment of the quality of the Smart Booster submissions.

> "We note that in March, 2012, Wilson Electronics submitted a coverage map purporting material improvement in performance by one of its products that allegedly complies with the specification of the Joint Proposal Consumer Grade booster….We doubt the accuracy, the reproducibility, and the interpretation of that coverage map. We especially doubt that the choice of location for Wilson's coverage map is representative for most of rural and undersevered America. In particular, the base station site is on a tall mountaintop overlooking the Escalante Desert near Big Mountain, Utah." (Page 11)

Population has no relation to the coverage area. The purpose was strictly to determine the increase in coverage area that a booster provides which is not dependent upon the population. The area was chosen because one cell site was able to cover this entire area without interference from other cell sites making it possible to get a very accurate coverage map utilizing only one cell site without interference from others.

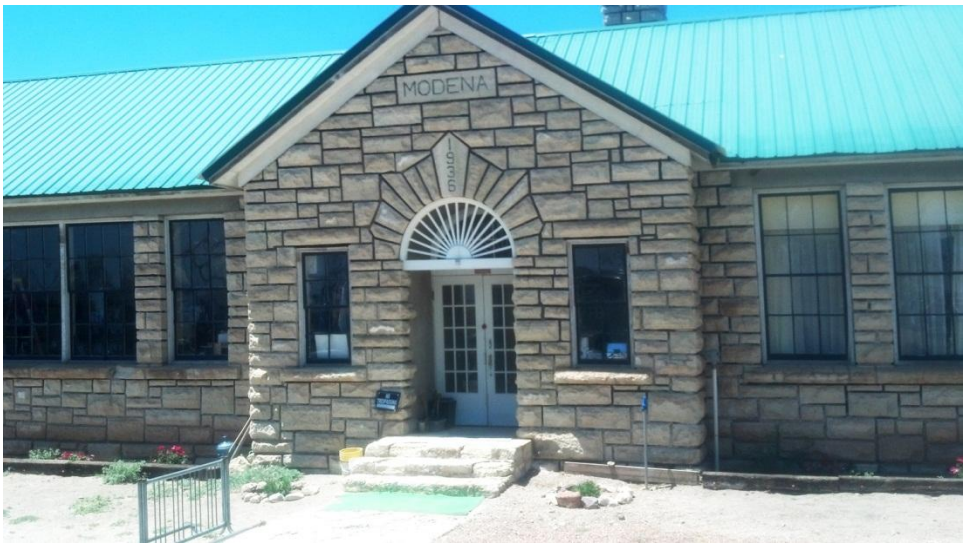
> "The terrain is mostly rock, devoid of any dense vegetation, and almost always lacking precipitation, all of which would, if present, require a significant fade margin for reliable wireless communication…No doubt, Wilson's coverage map assumes a fade margin of 0 dB, hardly realistic for most of the United States. A more representative example would have been in the Pacific Northwest, with areas of dense vegetation and steady rainfall, requiring a fade margin of at least 10 dB or greater. Under those conditions, a consumer equipped with a Joint Proposal Consumer Grade booster would be left stranded and perhaps endangered." (Page 11)

The measurements and results are representative of rural markets with good propagation conditions without significant environmental clutter losses. The measurement results include the fade margins necessary for reliable service. Other markets having more clutter losses due to the RF environment (i.e. suburban or urban markets, or rural markets with dense vegetation) would experience reduced coverage areas with a booster, and it would also reduce the coverage area for a cell phone alone without a booster by the same percentage. The ratio between the coverage area of a cell phone by itself and the coverage area of a cell phone with a signal booster (i.e. the 20 dB improvement) will therefore remain the same regardless of the environmental clutter factors. The environmental clutter factor is therefore immaterial to the relative improvement in coverage area. It follows that Smart Booster's statement that "...a consumer equipped with a Joint Proposal Consumer Grade booster would be left stranded and perhaps endangered" is misleading, because a signal booster will always

significantly improve the coverage area, e.g., by 20 dB or providing a 3 times increase in coverage area regardless of terrain factors as demonstrated in the tests performed with a Wilson ”Sleek” booster with approximately one watt power output. Smart Booster also mentions that one of the main spots on the map is a town of Modena, Utah with a population of 33. The population density has nothing to do with the coverage area. Whether it’s a populated area or an unpopulated area, the coverage area will not change with changes in the population density. Smart Booster's comment is completely irrelevant and has no bearing at all on the coverage map and the coverage area.

> “… the ghost town of Modena, Utah, population 33, with a commercial establishment shown in Fig. 3.” (Page 11)

As explained above, the population of Modena, Utah has no relevance to the issues being discussed. Smart Booster also shows a photograph (Fig.3) of a dilapidated building in order to support its allegation. In the interest of balance, the following is a recent photograph of the historic museum in Modena, Utah.



> “With respect to the coverage map’s accuracy, Fig. 2 suggests that the Joint Proposal Consumer Grade booster contains some undisclosed miraculous technology that depends more upon neutrinos than electromagnetic waves. Only neutrinos can penetrate the 7-1/2 miles of solid rock that dominates the 303-degree radial. Note that the first Fresnel Zone is completely blocked, and yet the coverage map shows robust signal beyond the blockage. How can this possibly be observed in the real world? In fact, it cannot. Even though there is a road passing behind the rock formation, according to Fig. 1, Wilson either never performed any measurements there or elected not to share them.

> Evidently coverage at that location was either assumed or interpolated. This is an outrageous assertion that casts serious doubt upon the credibility of the entire coverage map." (Page 11)

> "The 303-degree radial in the Wilson Coverage map is completely blocked by more than 7-1/2 miles of solid rock, including the entire first Fresnel Zone in both the vertical and horizontal planes. Yet the coverage map claims robust signal received beyond that obstruction, achieved by using a Joint Proposal Consumer Grade compliant booster. What is the miraculous technology that enables this, neutrinos? Surely electromagnetic waves cannot penetrate that obstacle." (Page 12, Fig. 2)

Once again Smart Booster demonstrates its lack of understanding of RF propagation. Measurements were taken from approximately 290 degrees to 320 degrees along the road at the outer perimeter of the coverage area. Both voice and data coverage was accessed with the booster at most points along the road. Coverage was actually extended beyond the shown coverage perimeter on the maps. This was due to knife edge propagation which is a very necessary and utilized propagation mode in mountainous areas.

In electromagnetic wave propagation the knife-edge effect or edge diffraction is a redirection by diffraction of a portion of the incident radiation that strikes a well-defined obstacle such as a mountain range or the edge of a building. The knife-edge effect is explained by the Hyugens-Fresnel principle which states that a well-defined obstruction to an electromagnetic wave acts as a secondary source, and creates a new wavefront. This new wavefront propagates into the geometric shadow area of the obstacle.

Even though knife-edge propagation is not completely reliable, nevertheless it is heavily relied upon in the west to give communications most of the time and in many locations it is 95% dependable. The typical improvement in signal strength by utilizing a booster in a home installation is generally about 20 dB (100 times). This is enough of an improvement to make knife-edge propagation reasonably reliable compared to almost no cell phone communications at all which would be the case without a booster.

Smart Booster failed to read the notes in Figure 1 of their own document (Fig. 2 in Wilson's document) saying: "The total coverage area with a Booster is 1006 sq. mi., 4 % has been deducted for mountainous dead spots." Considering the 1006 square mile coverage area with a booster, this would equate to approximately 40 square miles. The area that Smart Booster states is dependent upon neutrino penetration is approximately 10 to 20 square miles of dead area. If Smart Booster had read the notes on the map, their neutrino hypothesis would have been unnecessary since the dead zone has already been accounted for.

> "Furthermore, if Wilson's claim of 300 percent more coverage were ever realized in a metropolitan setting, the resulting pilot pollution incident on

> the handset from so many base stations would render it completely inoperable. No handset on the market today incorporates a receiver, or software, capable of organizing such a huge number of base station pilot channels. Consumers cannot possibly be expected to realize this deception and will naively purchase any device claiming such wild improvements in wireless coverage." (Page 11)

In all market settings including a metropolitan the Joint Proposal booster's protection algorithms examines the downlink power from all cell sites received by the booster. In an area of many cell sites, the gain of the booster will be reduced depending upon the strength of the closer cell sites. In these situations, the booster's gain may be reduced to the point where the cell phone will connect directly with the cell site and not through the booster. Smart Booster doesn't understand that in the aforementioned situation, the proposed technical standards will require a booster to reduce its gain to an appropriate level which, in some instances, is equivalent to allowing a cell phone to connect directly to a cell site without a booster, which is expected to occur in metropolitan settings. Therefore, the proposed standards will result in a very intelligent booster that considers all situations so as not to interfere with cell sites and affords a cell phone the maximum ability to communicate.

> "As a result, proponents of the Joint Proposal have totally ignored important technical interference considerations such as handset pilot channel pollution or Ec/No ratios, which are of critical importance in more urbanized settings. In fact, it is within these very urbanized areas that carriers have repeatedly complained about booster interference and have overwhelmed the CTIX database." (Page 13)

Smart Booster again does not understand that the new proposed technical standards require intelligent Consumer Boosters that power down to protect cell sites in a strong signal environment, e.g., in urban areas.

Again, Smart Booster doesn't understand the algorithms proposed in the Joint Technical Proposal (Safe Harbor provisions). These algorithms will allow intelligent signal boosters to follow the dynamic power range required by cell sites from cell phones thereby resulting in boosters being invisible to both cell sites and cell phones which precludes overload or interference in either the uplink or downlink directions.

> "More telling, the selected study area largely excludes other carriers, or for that matter, any communications towers other than the towers on Big Mountain. As a result, any consideration explained in detail in our Comments submitted on July 22, 2011, or interference to other operators within the study area are conveniently avoided. Furthermore, the selected study area is served only by the Verizon tower, perched atop a 7,200 foot mountain with no winter access, hardly representative of

> metropolitan and suburban areas where the vast majority of consumer grade boosters will be deployed." (Page 13)

The purpose of the study was to show coverage improvement with a booster in a rural area without interference caused by other cell sites. The area was selected so that there would be only one cell site covering the entire area without interference or cell site "jumping" (handoffs) by either the cell phone alone or by the cell phone with the booster. If there would have been cell site jumping, the test results would be convoluted, as the objective was to measure the improvements in cell site signal strength and range. Therefore, Smart Booster's allegations that the tests should be done on separate carriers has no validity. It would be impractical to attempt this study in an urban environment wherein the test cell phones would be constantly changing base stations as the study vehicle drove in and out of areas served by different base stations.

We also disagree with Smart Booster's above statement saying that that "…the vast majority of consumer grade boosters will be deployed…in metropolitan and suburban areas…". That has not been our experience. The majority of consumer boosters will be for rural areas where they are needed and will serve a valuable public service. This is not to say that they won't improve service in suburban areas or even urban areas wherever there is inadequate signal in people's homes, into businesses, and basements, etc. Their use in urban areas is beneficial wherever buildings shield and absorb RF energy from reaching cell phone subscribers. Although they will work in metropolitan areas, they will be automatically shut off most of the time or have reduced gain and will only turn on (or increase gain) when needed. Furthermore, with the protections proposed in the Joint Proposal, no matter where consumer boosters are located, there will be no interference to cell sites. They will be invisible to the system no matter where they are located.

> "The Consumer Grade signal booster described in the joint proposal is, in fact, not a booster at all but a signal suppressor …" (Page 15)

Signal Booster's statement is totally false. Signal boosters proposed by the joint proposal are shown by the Wilson coverage maps to extend the range of the cell phone to 3 times the area covered by the cell phone alone.

Conclusion

Smart Booster's repeated insinuations that only boosters employing its inadequate technology are "intelligent" and that the Joint Proposal boosters are not intelligent is worthy of special comment. This was addressed by Dr. Ray Nettleton in his August 2010 comments (resubmitted and posted in WT Docket No. 10-4 on July 23, 2012). Wilson signal boosters use downlink signal strength monitoring and amplifier gain control. That obviously constitutes "intelligent" functionality. Processors in the Wilson boosters currently execute over 100 pages of computer code.